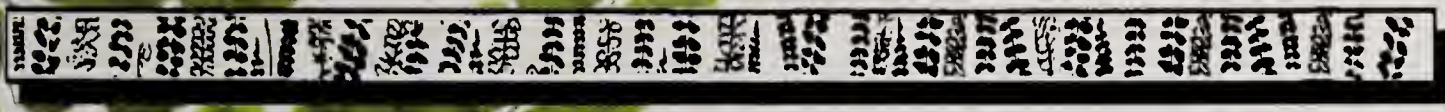


Hardy Fern Foundation Quarterly



Winter 2008

THE HARDY FERN FOUNDATION

P.O. Box 3797

Federal Way, WA 98063-3797

Web site: www.hardyferns.org

The Hardy Fern Foundation was founded in 1989 to establish a comprehensive collection of the world's hardy ferns for display, testing, evaluation, public education and introduction to the gardening and horticultural community. Many rare and unusual species, hybrids and varieties are being propagated from spores and tested in selected environments for their different degrees of hardiness and ornamental garden value.

The primary fern display and test garden is located at, and in conjunction with, The Rhododendron Species Botanical Garden at the Weyerhaeuser Corporate Headquarters, in Federal Way, Washington.

Satellite fern gardens are at the Stephen Austin Arboretum, Nacogdoches, Texas, Birmingham Botanical Gardens, Birmingham, Alabama, California State University at Sacramento, Sacramento, California, Coastal Maine Botanical Garden, Boothbay, Maine, Dallas Arboretum, Dallas, Texas, Denver Botanic Gardens, Denver, Colorado, Georgeson Botanical Garden, University of Alaska, Fairbanks, Alaska, Harry P. Leu Garden, Orlando, Florida, Inniswood Metro Gardens, Columbus, Ohio, New York Botanical Garden, Bronx, New York, and Strybing Arboretum, San Francisco, California.

The fern display gardens are at Bainbridge Island Library, Bainbridge Island, WA, Lakewold, Tacoma, Washington, Les Jardins de Metis, Quebec, Canada, Rotary Gardens, Janesville, WI, University of Northern Colorado, Greeley, Colorado, and Whitehall Historic Home and Garden, Louisville, KY.

Hardy Fern Foundation members participate in a spore exchange, receive a quarterly newsletter and have first access to ferns as they are ready for distribution.

Cover Design by Willanna Bradner

HARDY FERN FOUNDATION QUARTERLY

THE HARDY FERN FOUNDATION QUARTERLY

Volume 18 No. 1 Editor-Sue Olsen

ISSN 1542-5517



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The Spore Exchange Needs You!

Please send your spores to our Spore Exchange Director:

Katie Burki
501 S. 54th St.
Tacoma, WA 98408

Fern Quarterly –Winter 2008

Presidents Message

Winter is generally a time I use to reflect on the past year's accomplishments in the garden and to plan my future outdoor tasks. Walking through a thoroughly soggy garden and watching the noses of the spring bulbs popping up through the remaining fall debris reminds me that I have no time to reflect and have much to do. The winter rains have been frequent and heavy this winter in the Northwest and it is not encouraging to venture outside. Fortunately, several board members and volunteers braved the weather and installed a major planting at the Bellevue Botanical Garden. The Bellevue Botanical Garden (BBG) has been associated with the HFF for many years and it was a great opportunity to participate in the renovation of their rhododendron (and fern) glen. About 750 ferns were planted consisting of approximately 100 different taxa. The planting was funded by a grant from the late Harriet and Cal Shorts founders of the BBG and charter members of the HFF.

If you are ready for gardening and not willing to brave the weather, perhaps you would like to volunteer for the HFF at the Northwest Flower & Garden Show. The show is from February 20th -24th at the Seattle Convention Center in downtown Seattle. The booth is fun to do and you meet lots of interesting people. If you are interested contact Michelle Bundy at rsf@rhodygarden.org and remember volunteers get into the show for free!

The HFF will have a display booth featuring garden "furniture". A fern table landscaped by famous British fern grower, Martin Rickard and by yours truly will be the center piece. And don't miss the lecture, "Ferns for all Seasons", by board member and past president, John van den Meerendonk at 6:30 on February 21st. John is a lively speaker and will educate and entertain.

I will also be going to the Philadelphia Flower Show, "Jazz it Up", which will be held from March 2nd-9th and am planning to visit the "Entrée into Ferns" an outdoor café Art Deco exhibit presented by the Delaware Valley Fern and Wildflower Society. The society's award winning displays are always interesting, educational and popular. Their Celtic Garden was "Best of Show" in 2007. Also for those in the Philadelphia area Mt. Cuba specialists Gregg Tepper and Marcie Weigelt will be giving a lecture and workshop on "Native Ferns in the Landscape" on March 8 at the York County, PA Master Gardeners Garden-wise Day which will be held at York Suburban High School.

Those who wish to remain comfortably on a couch until spring thaw can enjoy the pages of our Quarterly. Alastair Wardlaw has written a unique article on heating cold frames. The arm chair vacationer can rest with part one of the fall 2007 Texas tour enjoyed by several HFF and British Pteridological Society members. I am personally excited to read the article on *Lygodium palmatum*. I have killed several of these plants in the past and hope to gain a little new insight on that difficult plant. For the fans of the long running species profiles Jim Horrocks has an excellent account of *Phegopteris connectilis*, the Northern beech fern.

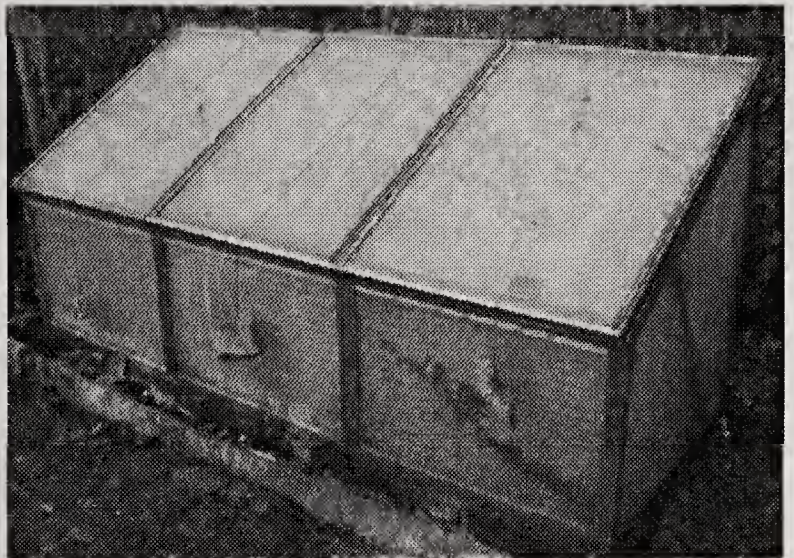
All the best in the New Year,

Richie Steffen

Anti-Freezing System in a Cold Frame

Alastair C. Wardlaw - Glasgow, Scotland

Visitors to our garden are sometimes curious about the anti-freezing system I use in the cold frame (upper picture). It consists of several 1-gallon plastic containers (lower picture) $\frac{3}{4}$ -filled with plain tap water and equipped with 6-foot lengths of crumpled aluminum kitchen foil, originally 12 inches wide. One end of each piece of foil reaches right down to the bottom of a water container, while the aerial part is draped loosely around the potted plants.



The water has no added anti-freeze because I am prepared for ice to form in the flexible bottles, and leave $\frac{1}{4}$ -space for it. The anti-freezing effect is based on high-school physics: to cool 1 cc of water from 33°F down to 32°F requires the loss of 5/9th of a calorie of heat. However to convert the water at 32°F into ice at 32°F requires the further loss of 43 calories – the so-called latent heat of fusion of ice. In effect, the water bottles act as latent-heat reservoirs.



On a very cold night, with the outside air at maybe 21°F, the air in the cold frame cools down but is prevented from going seriously below 32°F by the aluminum foil which conducts the cold down into the water, with its very high heat capacity. Next morning there may be, say $\frac{1}{4}$ -inch of ice on the water of each bottle, but underneath the ice, the water is no colder than 32°F. This 32°F goes back up the aluminum foil into the cold-frame air, and helps prevent the plants getting below freezing point. During a prolonged freezing spell, I replace any iced-up bottles and foil strips.

In a larger, walk-in cold frame, I use a 20-gallon plastic garbage bin $\frac{3}{4}$ -filled with water, and fitted with numerous strips of crumpled foil, up to 15-feet long. One end of each strip is fixed deep in the water, while the aerial part is draped among the plants.

Lygodium palmatum – A Fern Obsession

Joan Eiger Gottlieb, Pittsburgh, PA

I have a consuming desire to grow *Lygodium palmatum* (American climbing fern, also called Hartford fern) from spores to garden-size plants. Fresh spores have come my way from several friends over the years. They were easy to grow on soil-less “seed starter” mix available at every garden center and composed of finely chopped Sphagnum peat, perlite, vermiculite, and a wetting agent. Some brands also add bark or use it as the principal ingredient. A few weeks after sowing *Lygodium* spores, a green “fuzz” of filamentous prothalli is seen, followed quickly by somewhat lop-sided, heart-shaped plates. In 3-4 months, on well-moistened medium, sporelings appear, their juvenile, finger-shaped fronds a delightful and welcome sight.



Young *Lygodium palmatum*.

Alas, this early, sweet success was, until recently, inevitably succeeded by a slow fizzle as the sporelings became pale, translucent, and papery, literally fading away before my sorrowful eyes. Desperation often leads to innovation, so when Sue Olsen offered some spores in 2005, and the first sporelings appeared in the culture, I watered sparingly with a very dilute (barely blue to the naked eye) solution of water soluble (30-10-10) acid plant food (e.g. Miracid or similar products,) containing chelated iron, copper, zinc, and a mostly urea-based nitrogen source. Rainwater was used for the dilution. The pale plantlets began “greening up” and, to my amazement, a new, larger set of fingerling fronds appeared on most of them. More rounded, palmately-lobed, “toddler-stage” leaves followed in due course and I continued the acid fertilizer treatment every 3 weeks or so.

In early July, 2007 (about 2 years after sowing the spores,) when the culture was obviously overcrowded, I summoned the courage to transplant the robust, but still very juvenile plants. Equal parts of clean, coarse, river sand and chopped, fibrous Sphagnum moss (not the brown garden amendment sold in compressed bales) were mixed, and just enough well-rotted, leaf compost was added to provide humus and tilth. This mixture is the type of substrate on which I have been growing *Lygodium* in the garden (division courtesy of Mike Breiding from West Virginia.) It was spooned into a sturdy, low (bonsai-type,) well-drained container, tamped lightly to eliminate air pockets, and watered well with the rainwater/acid fertilizer combination. Using a narrow spatula, small scoops of sporelings were transferred to little depressions spaced an inch apart in the medium. Young *Lygodium* is shallow-rooted, making transplantation easy and minimally disturbing. No attempt was made to tease out individual plants, nor is that recommended. The dish was housed in a clear, plastic bag with strategically positioned sticks to maintain a few inches of space between the plants and their “greenhouse roof.” Bright, natural light (but no direct sun)

was provided.

By the end of July, “adolescent-type” fronds with elevated rachises were popping up and a hardening-off process was begun. The bag was left progressively more open and watered as needed with the dilute acid fertilizer. At the end of August the first twining (adult-like) leaves unfurled, although their growth was limited to just a few pairs of pinnae. These plants will spend the winter in a cool greenhouse (heated to 45°F). In spring, 2008 they will be planted outdoors in a prepared bed at the base of a pine stump. It is an area that formed when Hurricane Ivan toppled a huge tulip poplar on a neighboring property three years ago. The poplar, in turn, snapped off a mature white pine at the rear of the garden and a stump was created after the mess was cleared away. American climbing fern will, expectantly, be the keystone feature of the site. The designated space of about 9 square feet, which has clay soil, will be dug to a depth of about 8 inches and the diggings will be replaced by the same mix of river sand, fibrous Sphagnum, and leaf compost used for the first transplants. Rainwater will be collected for use during dry spells since tap water tends to be slightly alkaline and may contain calcium and other minerals not to the liking of the finicky, acidophilic *Lygodium*. Stay tuned for periodic updates as the project continues. However, I believe it is possible to raise garden ready plants from spores in about two years by using peaty/sandy substrates and watering with dilute acid fertilizer as needed.

Colonies of *L. palmatum* are often extensive in the wild, covering acres of ground on poorly drained, acidic soils, especially those that were disturbed in the past by logging and mining. This North American endemic has an impressive range from southern Ontario and Michigan to Mississippi and northern Florida. It is most abundant on the Cumberland Plateau of Kentucky and Tennessee, but sites are known in West Virginia, southern Ohio and northeastern Pennsylvania – classic coal country. I have seen it on dark, mucky peat, on sandy soil along acidic streams, in wet roadside ditches at the base of clay banks, and on the damp spoils of surface mines.

The late Warren (Herb) Wagner of the University of Michigan speculated¹ that “there may be symbiotic fungi or other factors” that are unmet in garden conditions so that “the climbing fern survives for a couple of years, usually dwindling in size and vigor until it dies.” This brought responses from Maine to Alabama² citing longevities of five to twenty+ years in cultivation. In these cases, however, the fern had been introduced to gardens that were naturally pre-adapted with damp, acidic, mineral-poor substrates. In the E. Sandwich, Maine garden of Shirley Cross *L. palmatum* had been thriving more than 20 years on black soil under high-bush blueberries. Virginia Otto’s long success with her colony near Boston (15 years when I saw it in 1994) may have been due to a bottomland location where hardhack and meadowsweet were natives. Edythe Crumpton in Birmingham, Alabama described her 5 year old colony as “spreading like a weed” in compost on natural, red clay soil (acidic and water retentive) “under pine trees with sweet gum and dogwood nearby...”

Anecdotal experience thus suggests an absolute requirement for moist, low-nutrient, acidic soils that are either natural in an area or must be provided by determined growers. Let us hope no special fungi are needed, because, as Wagner says,² “I know a lot of gardeners would love to have a colony of Hartford Fern.” He even proposed it as the “national fern” because of its popularity among American botanists. To satisfy the potential demand, it is

Continued on page 4

***Lygodium palatum* continued from pg. 5**

important to grow American climbing fern from spores so that plants can be made available commercially without disturbing the remaining wild colonies. Each of its large sporangia contains about 250 viable spores, so modest collection of fertile pinnae should provide adequate material for growers. Since 1869 the Hartford fern has been protected in all of Connecticut by an act of the legislature, making it the first plant given legal protection from “any person who shall willfully and maliciously sever or take (it) from the land...” George Yatskievych of the Missouri Botanical Garden urges³ local efforts by volunteer amateur and professional botanists to monitor such plant rarities in their immediate areas, augmenting the documentation of state-wide Natural Heritage Programs. We all need to raise public awareness about rare/endangered species, including plants, and to be advocates and stewards for our wild areas, nature reserves, and other parts of the “commons.”

What is it about Hartford fern that fascinates so many of us? Its interesting history, sporadic distribution, difficulty in cultivation, and appealing aesthetics would probably be quite enough to make the serious plant lover covetous and acquisitive. As a student of plant morphogenesis (development of form) I, personally, am drawn to the special architecture of its twining fronds (up to 10 feet for *L. palmatum* but as much as 30 feet for the Asian *L. microphyllum*, introduced and now invasive in southern Florida.) It is also noteworthy that these elaborate, highly complex leaves arise from rather ordinary, thin, subterranean stems with simple branching patterns and single conducting cylinders known as “protosteles.”

Most fern fronds undergo prolonged periods of growth, protecting their delicate, dividing cells (tip meristem) within coiled crosiers (fiddleheads.) Although their uncoiling growth is extended, it is also limited (**determinate**), concluding when a specific number of contained pinnae unfold and all the cells differentiate and mature. In an extreme extension of this pattern, the vine-like leaves of *Lygodium* are essentially unlimited (**indeterminate**), having an active tip meristem that grows until it is damaged or seasonally constrained. Thus, the rachis continues to elongate and new pinna pairs are added at a steady pace. In other words, the dividing cells at the tips of these leaves are long-lasting generative zones, much like their counterparts – the apical meristems of stems and roots. Actively dividing plant cells also synthesize growth hormones (auxins) that, at high concentrations, inhibit precocious branching. In the *Lygodium* frond it is possible that hormone levels near the frond growth tip also inhibit and delay pinna expansion. Indeed, the pinnae look like primordial nubbins until they are well below the leaf apex and the hormonal influence (concentration) is diminished. The result is a “search structure,”⁴ reducing the weight strain on the unattached frond tip as it seeks, finds, and twines around a support by unequal growth patterns. At the end of the warm, long days of the growing season, the terminal pinnae become fertile, finally ending the profligate growth spree.

Many plants climb with the help of adventitious roots or other outgrowths along upright stems (e.g., most climbing ferns, poison ivy.) Other plants produce suction-tipped branchlets (Virginia creeper.) Twining, in which a plant coils around (circumnutates) a host or a support, is also widespread and is a good example of convergent evolution among unrelated groups. In seed plants it can be the main stem (dodder) or specialized branch tendrils

(grape) that spiral around and grasp the support. Legumes like the garden pea have tendrils that are modified leaf segments. Only *Lygodium*, to my knowledge, has complex leaves that twine in their entirety. It can be said that plant organs (stems, roots, leaves) have a lot of functional, as well as developmental interchangeability –a revealing example of biological plasticity and potential. How could one not be fascinated and even a bit obsessed?

References:

¹ Wagner, Warren H. 1989. Hartford fern: First Protected Plant in America? *Fiddlehead Forum* 16:26.

² ibid. 1990. More on the Hartford Fern, *Fiddlehead Forum* 17:10.

³ Yatskievych, George 1991. Rare and Endangered Ferns and Concepts of Endangerment in the United States, *Fiddlehead Forum* 18:16.

⁴ Mueller, Richard J. 1983. Indeterminate Growth of the Climbing Leaves of a Fern, *Bioscience* 33(9).

Source: Cady's Falls Nursery in Morrisville, VT www.cadysfallsnursery.com.
Please note that they do not offer mail order.



Mature *Lygodium palmatum* Photo by Don Avery.

Texas Tour Part 1

Following a very successful joint BPS/HFF tour of Germany in 2006, Naud and Wim Burnett of Dallas, Texas graciously offered to host a fern tour of their part of the American southwest. We were delighted to accept their offer and so a group of fern enthusiasts gathered in October to see the wonders in Texas and Arkansas. Naud and Wim had done their homework very thoroughly and organized a wonderful tour combining the best of public and private gardens along with field sites and a nicely balanced selection of tourist attractions. Sincere thanks from all of us for a job very well done.

Sue Olsen

Day 1, 3rd October – Fort Worth

Pat Acock

After a short ride on the bus from Dallas to the sister city of Fort Worth we arrived at the Fort Worth Botanic Gardens where we were greeted by the director, who introduced us to John Langevin, who is responsible for their large conservatory which we were to visit. Inside were a wealth of botanical treasures. Amongst the ferns were many plants of *Didymochlaena trunctula*, *Adiantum peruvianum*, *A. capillus-veneris* and *Microsorium strigosa*. Growing epiphytically were single plants of *Pyrrosia longifolia*, *Phymatosorus diversifolius* and *Asplenium antiguum*. In the ground was a majestic *Angiopteris evecta* as well as *Blechnum gibbon* and *Blechnum brasiliense*. For me the nearly 3m tall *Acrosticum danaeifolium* stood out with its fertile fronds just ripe.

We were then taken by Cathleen Cook to see the ferns outside. After a short walk across a board walk through native forest where we saw the brown squirrel, we were taken to see a collection of ferns donated by our host Naud from his nursery Casa Flora. We went on to the Japanese garden which although beautiful and very large only had many plants of *Cyrtomium falcatum* and *Thelypteris kunthii* in their fern collection.

We moved on to the Kimball Art Museum where two of the spouses spent the afternoon after we had had a very good lunch.

A short drive found us at the Botanical Research Institute of Texas (BRIT). Here we had a mutually very informative and delightful afternoon. We were met by the director Barney Lipscomb, who introduced us to the history of BRIT and we were then taken for a very informative tour of the herbarium by Tiana Franklin who not only introduced us to the history and work going on with specimens but was very enthusiastic about her work. I was especially interested in the way the herbarium was used by students and the number of specimens they had was amazing.

We next met the librarian who gave us a brief history of how the library started in 1946. He then proceeded to show us some of the literary treasures of the collection. These included "The Ferns of North America" by Eaton and the incredible "Rare Plants from the Emperors' Garden in Schoenbrunn". The volume we saw of the ferns contained line drawings, which were hand colored by a team of artists. The book came about when during the

mini ice-age in the 1880s, the Empress Marie-Teresa's hothouse collection of plants was devastated and she resolved to rebuild the collection by sending botanists into the field to recollect the plants lost. She then had a complete record of the plants recorded for posterity by artists in 200 copies of the book.

Tiana then took us to see the way the herbarium sheets were being scanned and made available with other information for workers around the world. BRIT has digitalized all their type specimens and they are now working on the rest of the collection. These can be seen on www.brit.org

Too soon we were on our way to the charming garden of Judy and Joe Caughlin. The garden was beautifully placed overlooking Dallas and one had a much better view of the way the area looked before the twin cities developed. The garden had a whole range of beautiful plants with water features and statues complimented by ferns such as *Arachniodes aristata*, *Dryopteris ludoviciana*, *D. championii*, *Thelypteris kunthii* and *Cyrtomium falcatum* 'Butterfieldii'.

Day 2, 4th October – Dallas Sue Olsen

Our day 2 tour could aptly and accurately be titled "Highlights of Dallas", at least for the garden minded. After an interesting spin through the comfortable residential areas where the well to do, such as the owner of the Dallas Cowboys football team, reside, we headed for the 66 acre Dallas Arboretum. Here is the horticultural gem of the city including notable gardens, the Jonsson color garden, the Trammell Visitor Center and the Palmer Fern Dell, some 15 acres in all, designed by our host Naud Burnett and his landscape design company.



The Pumpkin House at Dallas Arboretum

After a visual introductory presentation we eagerly left for our visit to the fern dell, passing on the way the Halloween themed pumpkin displays, some 20,000 in all as well as 30,000 chrysanthemums, designed to entertain October visitors. The dell covers just over an acre in a shaded but prominent area. This is a Hardy Fern Foundation display garden and the collection includes some 160 different fern types ranging from temperate species and cultivars to tropics. The latter are added for seasonal interest in the spring to autumn months and removed to the safety of frost free comforts for the winter. Fog from a tree mounted mist system that spans the dell sprayed lightly and periodically to cool both the visitor and the plants. The mist lowers the ambient temperature by approximately 10 degrees and makes it possible to maintain a healthy green, rather than crispy brown, collection throughout the hot summer. Designed for both aesthetics and education the garden

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Texas Tour Part 1 *continued from pg. 9*

exhibit includes like-minded ferns such as *Dryopteris celsa* and *D. ludoviciana* in close proximity and in juxtaposition with healthy stands of exotic tender ferns including *Hemionitis arifolia* and a crowd favorite, albeit a nursery and tropical “weed”, *Pityrogramma calomelanos*.

All too soon we were off to lunch, but there were other garden delights to explore before leaving. I fondly remember water features from my visit in the 1990’s, but a new to me attraction was the pool in the “Woman’s Garden” that faced the distant White Rock Lake without interruption giving it a coherent continuance as if it were part of the lake. Further along we found fanciful Halloween attractions including a “pumpkin house”, yes made of pumpkins and tall enough to visit as a walk in guest. Cameras hummed.

After lunch we spent an interesting and educational afternoon at Casa Flora, Naud’s distinguished wholesale nursery. Founded some 41 years ago, with ferns introduced in the third year, the nursery now ships approximately 16 million ferns worldwide making it an international leader in production and distribution. We were divided into small groups allowing experts Shanti Claycamp, Jose Aguirre and Kent Kratz to share their specialized knowledge with us. We learned about their propagation techniques including both spore production and tissue culture, transplanting procedures, and growing on in huge automated temperature controlled greenhouses housing thousands of plants per lengthy bench. As a finale we admired carts of the finished product awaiting shipment. It was fascinating.

Thus educated, I must admit, however, that the most popular attraction was the huge greenhouse filled with stock plants. The group approached with what might politely be called “lust let loose”. Here were Naud’s treasures from the familiar to the exotic, the temperate to tropical, and xeric to epiphytic, all too numerous to name. It was a very special ending to a very special day. My warmest thanks go to you, Naud.

Day 3, 5th October-Garvan Woodland Gardens and DeGray State Park Martin Rickard

The day started with a three and a half hour coach journey, but it seemed we reached our destination in no time at all. We sat down straight away for a traditional Southern lunch in the former Confederate capital of Washington, Arkansas. After lunch we were given a rapid tour of this very small town run as a museum. We were fascinated by its history during the Civil War and how settlers used to pass through. Apart from *Pleopeltis polypodioides* on many trees, we saw no ferns.

We were quickly back on to the bus and whisked away to Garvan Woodland Gardens, not far from Hot Springs, about 50 miles southwest of Little Rock. We were shown around the garden here by Don Crank, a local fern enthusiast. Many ferns had been introduced but some were native. It was not always easy to tell the difference! Apart from common species it was a pleasure to see *Botrychium biternatum* and *B. dissectum*, our first cheilanthes – *C. alabamensis*, *C. lanosa* and *C. tomentosa*, as well as *Woodwardia virginica* and *W. areolata*. Still of interest, despite their demise as ferns, were *Selaginella braunii*, *S. uncinata*, *S. apoda* and *S. kraussiana*. Before leaving this wonderful lakeside garden we were

shown the Anthony Chapel – a truly extraordinarily beautiful building in the tradition of Frank Lloyd Wright. You need to see it to understand!

Dusk was setting in as we left for our overnight destination at the De Gray Lake Resort State Park. A magnificent hotel...but sadly in a dry county! Conversation over dinner was more ferny than usual!

Day 4, 6th October – Ouachita National Park

Alan Ogden

It was another fine hot day, our first for exploration of natural sites. Our hotel, the DeGray Lake Resort Lodge was on an island in the DeGray Lake, Arkansas and offered many interesting outdoor activities but we were off early on a long bus ride to Ouachita National Forest (pronounced wash-ah-taw). Naud had arranged for a couple of local experts to lead us, Theo Whitsell who is a botanist for the State of Arkansas and Dr. John Simpson, a man with much knowledge of the area.

When we arrived at the forest Theo gave us a short talk about the area which has Paleozoic rocks with much faulting which leads to great plant diversity. He also told us about the venomous snakes and the poison ivy common in the forest.

Thus prepared, we plunged in Indian file into the woods, enveloped in a cloud of insect spray and midge repellent – enough to frighten off any wildlife. We were immediately rewarded by *Botrychium biternatum* with a fresh fertile spike and *Thelypteris hexagonoptera*. The American botrychiums are very attractive. When is someone going to solve the problem of growing them in Britain? A short distance further on we met *Polystichum acrostichoides* and *Asplenium platyneuron*, both old friends by now.

We had been told that we may have to wade some streams but the water level was low enough for us to hop from stone to stone. Here we found *Athyrium filix-femina* subsp. *asplenioides* though I must admit that the minor differences between the American athyriums elude me. *Onoclea sensibilis* was there too, another old friend which is common in damp areas all over the eastern half of the continent. There was some debate over a large *Dryopteris* (when isn't there?), which was finally diagnosed as *D. celsa* and there were two osmundas, *O. cinnamomea* and *O. regalis*, the latter being subtly different from the European form. *Woodwardia areolata* was growing in standing water.

On the branches of some trees was the “resurrection fern”, *Pleopeltis polypodioides*, an attractive little fern. Another *Thelypteris*, *T. noveboracensis* and *Pteridium aquilinum* var. *pseudocaudatum* made up the collection in the flat wet area.

The ground began to rise and Theo showed us the remains of some spring orchids and a large *Dryopteris x australis*. On the higher ground he located an elongated patch of *Adiantum pedatum*. John Simpson recalled it was the site of a fallen tree many years ago. Here we turned to make our way out of the wood and discovered a solitary specimen of *Botrychium virginianum* at the foot of a tree. We didn't see any snakes but John Acock photographed a blue salamander and a spring peeper frog which resembled a dried leaf. By the stream were little mud piles like molehills – the presumed home of crayfish.

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Texas Tour Part 1 *continued from pg. 11*

We emerged from the wood at 11:00 am. to be proudly shown *Equisetum arvense* which is rare in these parts in the verge! Also seen by the road were *Dryopteris celsa*, *Thelypteris kunthii*, a *Woodsia obtusa*, a *Selaginella apoda* and *Thelypteris palustris* by the stream.

Climbing back into the bus for a welcome cooling off we then had a short drive to a working quarry where the tortured patterns of the exposed rock strata were spectacular. We had come to see the *Lycopodiella appressa*, another Eastern species which had widely colonized the undisturbed areas of the quarry base. I found a fascinating specimen which I had not seen before in a clubmoss. A few terrestrial orchids were seen too.

We ate our picnic in an area of Brady Mountain by Lake Ouashitaw, a pleasant interlude before another short drive brought us to a steeply sloping dry, hot and sunny wooded area with small oak trees and dry grass. *Cheilanthes tomentosa* along with *Cheilanthes alabamensis* and *Pellaea atropurpurea* grew in this unlikely place wherever rocks gave a haven for the roots along a small cliff. One could only admire the delicate little ferns which thrived in these hostile surroundings!

Another short roadside foray revealed *Equisetum hyemale*, *Thelypteris hexagonoptera*, *Athyrium filix-femina* subsp. *asplenioides* and *Dryopteris marginalis* before we made our way back to the DeGray Lodge, dropping off our guides at their vehicles. Their local expertise had been essential and we thanked them warmly.

Those with an appetite for more ferning explored one of the short trails near the Lodge where we immediately found *Woodsia obtusa* and *Asplenium platyneuron* by a bridge over a dry creek and *Pleopeltis polypodioides* on the tree branches. Close by was a very large *Botrychium* which was at first thought to be *B. virginianum* but the woods contained so many examples of large and vigorous *B. biternatum* just reaching maturity it must have been the same species. One of the specimens found had a fertile frond measuring a good two feet.

Day 5, 7th October-Caddo Lake and Nacogdoches Pat Riehl

What a beautiful sunrise this morning. We left the DeGray Resort after a two night stay. My thanks to Naud for planning several occasions of two night stays in the same hotel. We had a long bus ride to Nacogdoches but stopped at a rest station that is also a Texas Tourist Station. It is doubtful that they had any Texas maps left once we were gone. Everyone had at least one map and all sorts of other brochures. The bus was filled with the sounds of maps unfolding.

Our first stop of the day was Caddo Lake, named after a native American tribe, for a boat ride to see the cypress swamps. The boats were reserved for us at the end of a street called Hog Wallow in a small "rustic" town called Uncertain. We had two flat bottom boats to take us out on the lake for an hour's sightseeing while also enjoying lunch. It was a fascinating hour.

Caddo Lake is the largest natural fresh water lake in the south. The lake covers 34,500 acres spread across areas of Texas and Louisiana. The water level is controlled now by a dam. It is an eerie place. Cypress trees hundreds of years old are draped in Spanish Moss, a bromeliad. Unfortunately a water fern called *Salvinia molesta* is a major threat to the lake. The name should make its character pretty clear. Presently due to efforts from Texas it is mainly on the Louisiana side. Those who enjoy and use the lake in Texas are making a serious effort to keep it out. Look for a relevant article in the "New York Times" on July 25, 2007.

We then went on to Nacogdoches to tour the Stephen F. Austin College's Mast Arboretum with Roger Hughes and Dr. David Creech. Dr. Creech is a recently retired professor from the college and is now head of the arboretum. A staff of five and a volunteer crew take care of the 60 acre arboretum. Roger was largely responsible for installing the ferns in this arboretum but unfortunately is no longer involved. The garden is classified as zone 8 and gets about 48 inches of rain per year. They have a hot, humid, dry summer. The tour was a whirlwind following a plant sale. We inspected the left over ferns including *Dryopteris ludoviciana*, *Dryopteris championii*, *Athyrium otophorum* and *Woodwardia orientalis* just to name a few. Lucky for me they were tagged so I didn't need to ask, "What's that?" I did learn that *Athyrium* 'Ghost' will grow crested fronds in very hot weather then when it cools return to normal. There was also a curiosity, an *Amorphophallus titanum* called "Jack", whose corm weighted in at 26 pounds.

At one point we crossed a flood canal bridge and found ourselves in an area of ferns albeit rather a sad location for them. There was simply not enough water and it seemed a very lost and forgotten area. Many of the ferns were mislabelled, which was not helpful to me or the public. We moved through at breakneck speed with lots of winding trails causing some of us to lose the main group. We did happen upon some cheilanthes and pellaes though there were some questions as to which ones they were. There was a wonderful patch of *Polypodium (Pleopeltis) polypodioides* on the roof of a little shelter building. For the most part I quit taking notes: it was hot; the mosquitoes were out in force; I was lost and it was not a happy ferny experience.

We all found our way back to the bus and went to the National Center for Pharmaceutical Crops. Here we met Dr Shiyu Li who has been working on the use of plant extracts as possible cancer treatments since 1999. His goal is to identify native plants that may help in fighting cancer. So far they are working with Button Bush, *Cephalanthus occidentalis*; Red Buckeye, *Aesculus pavia*, and *Camptotheca*, the Chinese Happy Tree. The interest for us was that they are looking at ferns as well. The center has received a grant from the CDC to study weeds and ferns. Ferns are considered good research subjects because they are usually virus free. The fern candidates now are bracken, *Pteridium aquilinum*, and the resurrection fern, *Polypodium (Pleopeltis) polypodioides*. One problem is quantity. With bracken this is not a problem, but with some other species it is.

We then left for the Hotel Fredonia and dinner at an Italian restaurant with our host for the day joining us.

Continued on page 14

Texas Tour Part 1 *continued from pg. 13*

Day 6, 8th October-Enchanted Rock

Klaus Mehltreter

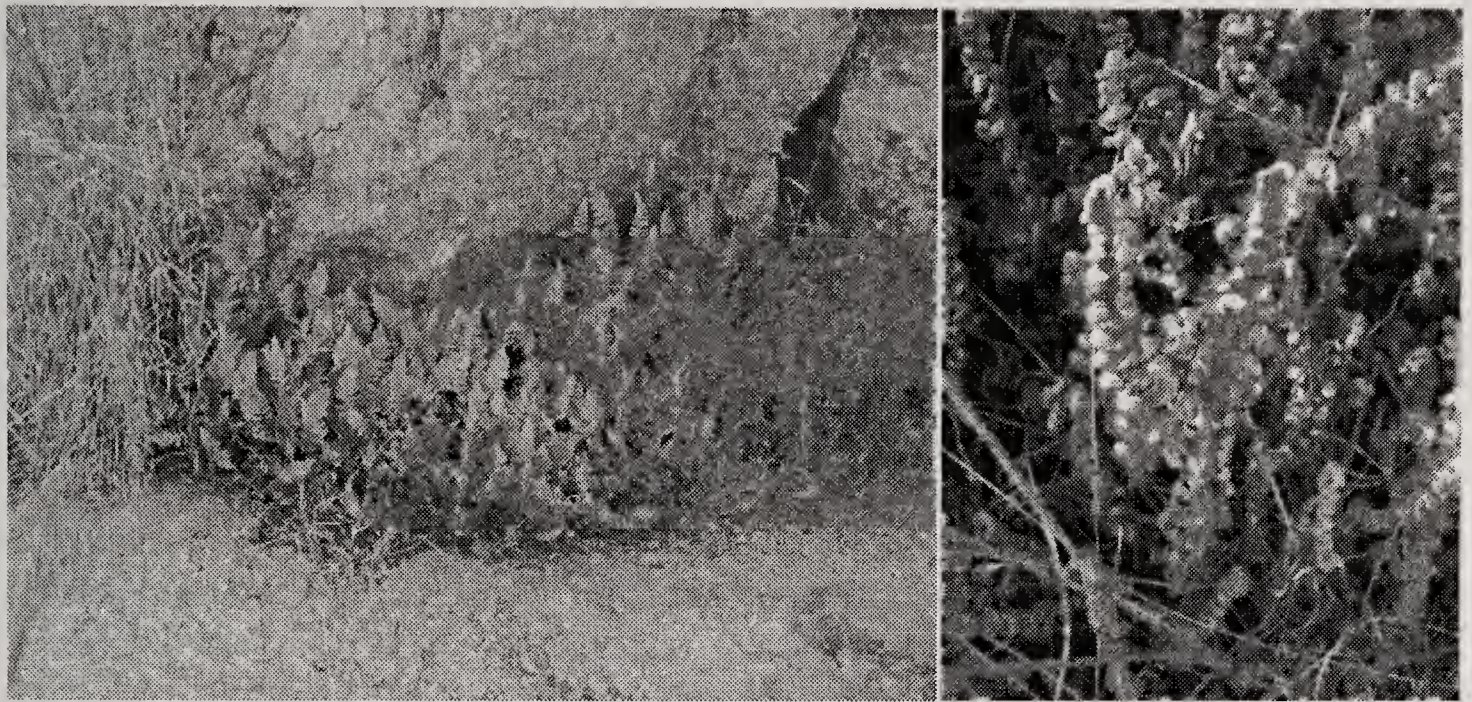
We left our hotel in Nacogdoches at 8:15am heading southwest to our next destination Salado. After a 3 hour drive through a changing landscape from Pine-Oak forests to Mesquite savannahs (*Prosopis glandulosa*) and pastures we arrived at the Stagecoach Inn, an old charming restaurant that Naud had known for more than 60 years.

After just a broth, a huge salad and a delicious dessert, we were ready for our field destination, Enchanted Rock State Park, near Fredericksburg, where we arrived at 4:30pm. Even for the late afternoon and the cloudy weather, it was still hot (about 85°F) but windy. Enchanted Rock is located in Llano County and presents a huge granitic dome of precambrian origin. Its peak reaches an elevation of 1825 ft and surpasses the surrounding landscape by about 400 ft. The pink granitic rock with an age of 1.25 billion years was uplifted in the Tertiary and scraped clean by erosion from overlying sedimentary Cretaceous rocks. Its name makes reference to the creaking and groaning noises caused when blocks grind against each other during the expansion caused by solar heating during the day and the following contraction during the cooling nights. However, we did not hear anything else other than the wind on the top from where we enjoyed an incredible outlook into the surrounding plain with several other granite formations, and observed instead several enchanting fern species.

The most abundant species, taking advantage of cracks and following fissures in the rock, were *Cheilanthes lindheimeri* with its wide brown costal scales on the lower leaf surface, and *Cheilanthes tomentosa*, which has only dense tomentose hairs on the leaf surface beneath. Both species formed mainly pure colonies and only mixed sometimes up with a mat forming, erect species of *Selaginella*. The two dominating species of cheilanthes were especially happy on east facing slopes where they were in the shade during the afternoon. Although present in other places there, the leaves and pinnae were completely inrolled, showing their lower leaf surfaces covered with hairs and/or scales. A third species, *Cheilanthes kaulfussii* was immediately spotted by Patrick who observed it only on the lowest sites, growing in the surrounding vegetation but not on Enchanted Rock. *Cheilanthes kaulfussii* could be distinguished easily from the two other species by its glandulous and pentagonal leaves. Not surprisingly we could not find *Cheilanthes alabamensis* which has been recorded for this site, because this species prefers mainly limestone.

The genus *Pellaea* was also present with three species. *P. ovata* with its characteristic zig-zag shaped rachis was common, while a dozen *P. ternifolia* were observed. *P. wrightiana* was only spotted once. *P. ternifolia* has pinnae with 3 pinnules and the pinna midvein below is distinctly colored from that of the lamina, while *P. wrightiana* has mostly 5 pinnules on the basal pinnae and the pinnae midvein and lamina below are the same color. Both species have strongly mucronate, i.e. acute spine like tips to the pinnules. On the way back, we located a second species of *Selaginella* with prostrate stems and roots on the branch nodes, resembling *S. peruviana*. Because it was completely dry and sterile, its identification remained doubtful.

After this exciting excursion into Texas' geological history and rock ferns, our driver brought us during sunset to Fredericksburg, an old German settlement with a nice Biergarten and shops, where we stayed for the night in the Fredericksburg Inn.



Cheilanthes lindheimeri, hydrated open leaves (left), dry inrolled leaves (right)



Enchanted rock

Pellaea ternifolia

Photos by Klaus Mehltreter.

Continued on page 16

Texas Tour Part 1 *continued from pg. 15*

Day7, 9th October – Austin

Jennifer Ide

The day began with a two and half hour journey to Austin, capital of Texas. Our first visit was to the garden of James David. A landscape architect by training James David described himself as ‘just a gardener’, explaining that he “grows what he enjoys growing, so his garden is full of ‘wacky’ stuff”. A persimmon tree laden with large fruit was the first plant to greet visitors at the front gate. Just a few steps further and one soon realized that this garden is an eclectic mix of flowering shrubs, cycads, cacti, flowering herbaceous perennials, ferns and grasses planted, seemingly somewhat casually in beds or pots, and garden features including a rill down a flight of steps into an ornamental pond, a swimming pool and clipped box hedges. Trees, festooned with climbers, provided the shade. The ferns, scattered around the beds of the garden, included *Woodwardia orientalis*, *Blechnum appendiculatum*, *Dryopteris sieboldii*, *Cyrtomium falcatum* and the ubiquitous *Thelypteris kunthii*. Four species were identified on various walls around the garden: *Cyrtomium falcatum*, *Microsorium diversifolium*, *Drynaria (quercifolia?)* and a Boston fern *Nephrolepis exaltata*.

We moved on to the Zilker Botanical Garden in the same neighborhood. Here we were met by Laura Joseph, of the Austin Garden Club, who was responsible for our itinerary in Austin. The garden is described as a “botanical showpiece for native (Texan) foliage plants, roses, ponds, an oriental garden and 100 million year old dinosaur tracks!” In the Japanese garden, a small colony of *Thelypteris kunthii* had us guessing for a while as it was growing in the open sun rather than shade and its fronds were leathery and coarse with prominent sori all in contrast to its normal shade form. *Adiantum capillus-veneris* and *Asplenium platyneuron* grew in a falling cascade of ponds. A narrow wooded area separating the rest of the gardens from the Visitors Centre was under-planted mainly with ferns, which included *Cyrtomium falcatum*, *Astrolepis sinuata*, *Dryopteris filix-mas*, *Athyrium niponicum* ‘Pictum’, *Dryopteris cystolepidota*, *Pteris vittata*, *Blechnum brasiliensis*, and, of course, *Thelypteris kunthii*. The tree ferns *Cyathea cooperi* and *Dicksonia antarctica*, a large *Nephrolepis exaltata* in a large ceramic pot and two enormous clusters of *Platycerium alcicorne* hanging from the branches of a tree, provided eye-catching features.

In the Hartman Prehistoric Woodland Garden, a life size *Ornithomimus*, the foot prints of which were discovered in the gardens in 1992, ‘inhabits’ an island over which drifts of mist help to create a steamy prehistoric atmosphere. In the surrounding garden, spore bearing plants such as the ferns, horsetails and liverworts, represent the types that existed at the time of the dinosaurs. Examples of the more primitive angiosperm families, magnolias, dogwoods, witch hazel, laurel, palms and birches, are set against a backdrop of plants originating from the Jurassic period conifers, bryophytes, horsetails, ferns and cycads. Of the latter, the garden boasts six species. The pteridophytes are represented in the garden by *Dryopteris erythrosora*, *Dryopteris x australis*, *Cyrtomium falcatum*, *Thelypteris kunthii*, *Astrolepis sinuata* and the tree ferns, *Cyathea cooperi* and *Dicksonia antarctica*. Also of particular interest, was a colony of *Equisetum*, possibly *E. giganteum* as well as *E. variegatum* and *E. hyemale*. Extensive carpets of *Marsilea macropoda*, grew atypically for a *Marsilea* in dryish soil; prolonged flooding would kill it.

After a short welcome by Sara Macias, the Central Parks Division Manager, we had lunch, provided by the ladies of The Garden Club of Austin. Then it was across town to the Lady Bird Johnson Wildflower Center. Lady Bird Johnson, wife of President Johnson, was a great lover of the American countryside and especially its wild flowers. She set up the center for research and encouraged the growing of local native flora in gardens and along the major highways of the United States. The mission of the gardens and the Center is the protection and preservation of North America's native plants and natural landscapes especially those of Texas. Unfortunately, there were few ferns in the garden. Two or three of the demonstration garden plots featured *Thelypteris kunthii*, *Adiantum capillus-veneris* and *Arachniodes simplicior* var. *variegata*. In the dry lands demonstration area, behind the Research Centre buildings, *Astrolepis cochisensis* and *Cheilanthes alabamensis* were included in the plantings.

Our fourth and final visit was to the Town Park, newly opened on 22 August this year. There were no ferns here, but our Austinian hosts were obviously thrilled with the city's new facility and wanted to show it off, especially its main three features: a retaining lake to take, after heavy rain, the overflow from the Colorado River, which flows through the town; an interactive fountain and an observation hill. It was the interactive fountain with its series of vertical water jets, which play a 15 minute sequence of patterns from ground level, which we enjoyed most. Fortuitously a young girl, perhaps 3 or 4 years old, came to play in the fountain and enchanted us with her squeals of delight as she played so imaginatively with the water jets. Nearing 6 pm, it was time to book into our hotel, unpack, refresh ourselves and set out for Congress Avenue Bridge, opposite the hotel, to go – bat watching! Approximately 20 years ago, free tailed bats began to roost under the bridge. Today, there are estimated to be over one and a half million of them! Expected to leave their roost and fly en masse up stream at approximately 7:15 pm, inexplicably this night, they chose not to leave for their nightly flights before 8 pm. Even so, it was a spectacular sight as they flew out from under the bridge in their thousands.



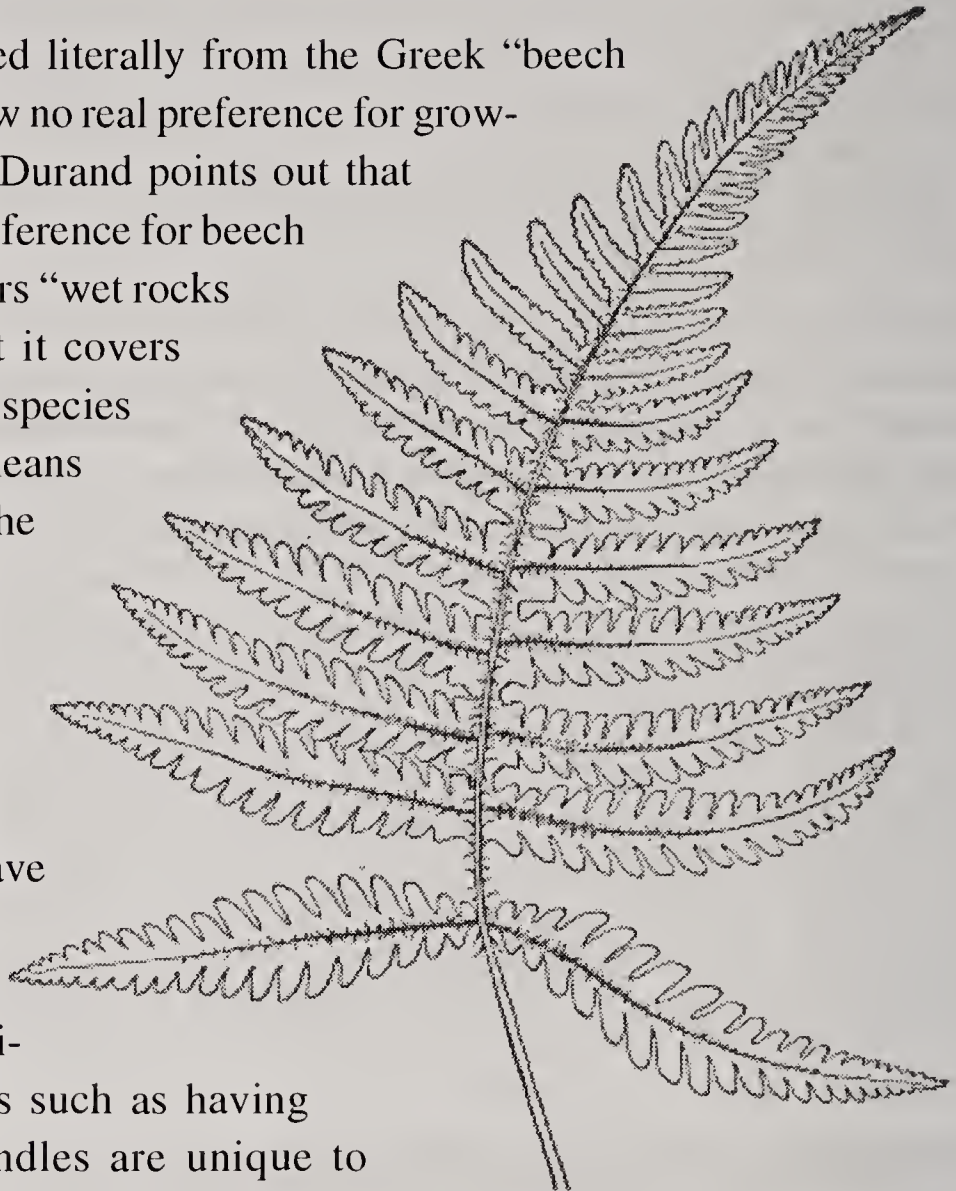
Austin Fountain.

Phegopteris connectilis

Northern Beech Fern Long or Narrow Beech Fern

James R. Horrocks
Salt Lake City, Utah

Phegopteris is translated literally from the Greek “beech fern” although they show no real preference for growing under beech trees. Durand points out that *P. connectilis* has no preference for beech trees but certainly prefers “wet rocks and dripping cliffs that it covers as with a curtain.” The species epithet “connectilis” means ‘joined’, referring to the upper pinnae being broadly attached to the rachis. This species along with *P. hexagonoptera* and *P. decursive-pinnata* have been often classified under *Thelypteris*. However, certain botanical features and details such as having only two vascular bundles are unique to *Phegopteris*.



Phegopteris connectilis

The northern beech fern is quite common in Eurasia and northern and eastern North America, ranging from Alaska down through Washington State across to Saskatchewan and from Labrador to Ontario and southward to the northeastern states. It is found growing in moist acidic soils and is epipetric in shady crevices of rocks. It is abundant among moist rocks, especially on the margins of streams and still pools, and can be quite dense on mountain slopes and stony woodlands, often found growing beneath bracken fern. This species is apogamous and usually triploid. It hybridizes with *P. hexagonoptera* in some localities in northeastern Canada to produce tetraploids that have larger and wider fronds.

Description: The rhizomes are long and slender, being 1 to 3 mm in diameter, branching and creeping extensively just below the surface. The rhizomes exhibit ovate to lanceolate pale brown scales. The distant stipes are slender and rounded, scaly at the base and wrapped in hairs and narrow brown scales. The tan-green to straw colored stipes are about half the length of the frond. The fronds are deciduous and from 8 to 15 inches long. They are triangular or more precisely narrowly deltate, pinnate-pinnatifid or bipinnatifid, with 12 to 15 pairs of soft-velvety, rather thin textured pinnae that are displayed in a horizontal fashion. New fronds appear in succession until late summer and are a bright green. The lowest pair of pinnae are separated from those above by a space of wingless rachis and point downward and forward and are not attached to the rachis with wings as are those above. The pinnae above the lower pair are broadly attached to the rachis but are not connected to each other as in *P. hexagonoptera*. The lobes taper upward toward the apex and are rounded. The small round sori are placed near the end of a vein in one submarginal row and lack an indusium.

Culture: *P. connectilis* is best grown in an acid soil among rocks and in climates that do not heat up too much in summer. It is extremely cold tolerant and once established is quite drought tolerant. Slugs can be a problem so protection is needed. Although it sometimes grows in sun in the wild, it should be restricted to a shaded garden area under cultivation. In mass plantings, it is very effective and attractive. Not being as large as *P. hexagonoptera*, it makes a very good ground cover. This species should not be attempted in basic soils, as it is short-lived in alkaline conditions. The most important factors for its success are acidity, moisture, and a cool root run.

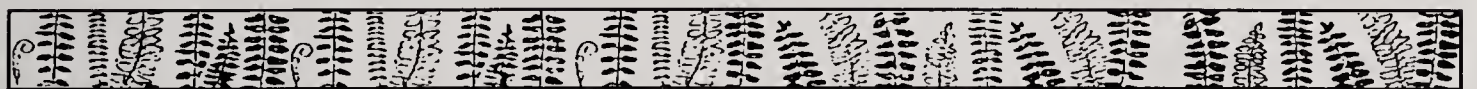
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Field Book of Common Ferns (1949) Herbert Durand, G.P. Putnam's Sons, New York

Encyclopedia of Garden Ferns (2007) Sue Olsen, Timber Press, Inc. Portland, OR



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♦ 2 0 0 8 ♦

To Order: Please print your selections in alphabetical order. Include 50 cents for each fern requested, postage (Check made payable to Hardy Fern Foundation) and a self addressed bubble envelope (please do not attach the postage to the envelope). If you are ordering more than a half dozen packages, please send additional postage up to one dollar's worth. There are no additional charges applied to overseas members, but please enclose an international postage coupon (2 for large orders) and an envelope. Please list a first and second choice. Some items are limited, so order early for best selection. If both choices are unavailable, would you like to donate the additional money to the foundation, or hold it for another order? If neither is indicated, we will consider it a donation to our endowment fund. At this time orders are not taken from the internet, so please follow instructions above. Orders will be sent within a month of post mark date.

Your fresh spores are always appreciated!!! We are trying to restock our inventory this year, so please consider collecting spore and donating it to the exchange. (Please package with collector's last name and year collected on package - individually packaged spore is much appreciated)

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Katie Burki
HFF Spore Director
501 South 54th Street
Tacoma, WA 98408

Genus species	var. or cv.	Year	Donor(s)
Adiantum aleuticum	'Subpumilum'	?	RSF
Athyrium filix-femina		'07	Peachy
Blechnum wattsii		'07	Olsen
Cheilanthes eatonii		'07	Olsen
Dryopteris arguta		'07	Olsen
Dryopteris arguta	RAS07005	'07	Steffen
Dryopteris clintoniana		'07	Olsen
Dryopteris cordata		'07	Wolfram
Dryopteris decipiens		'07	Olsen

Dryopteris filix-mas	'07	Peachy
Dryopteris formosana	'03	RSF
Dryopteris lepidopoda	'03, '05, '07	Hill, RSF, Olsen
Dryopteris ludoviciana	'02, '03, '06	RSF, Hay
Dryopteris marginalis	'03	Hay, Briegel
Dryopteris namegatae	'05	RSF, Olsen
Dryopteris pycnopteroides	'03-4	RSF, Gassner
Dryopteris remota	'00	RSF
Dryopteris sacrosancta	'00	McGill
Dryopteris scottii	'03	RSF
Dryopteris sieboldii	'01, '05	Hill
Dryopteris spinulosa	'03	Briegel
Dryopteris sublacera	'05, '04	RSF, Gassner
Dryopteris wallichiana	'01	RSF
Gymnocarpium oyamense	'03, '06	Gassner, Duryee
Humata pectinata	'07	Wolfram
Llavea cordifolia	'03	Swartz
Lygodium scandens	'03	Briegel
Matteuccia orientalis	'05, '06	Limberger, RSF
Matteuccia struthiopteris	'03	Briegel
Nephrolepis exaltata	'03	Briegel
Onoclea sensibilis	'03	Briegel
Pellaea cordifolia	'00	Swartz
Pellaea rotundifolia	'05	Limberger
Phyllitis scolopendrium 'Digitata'	'01	Mandeville
Phyllitis scolopendrium 'Americanum'	'07	Cady's Falls Nursery
Phyllitis scolopendrium	'01	RSF
Polypodium glycyrrhiza	'03	RSF
Polypodium scolieri	'01	RSF
Polystichum acrostichoides	'03	Briegel

Continued on page 22

Spore Exchange List *continued from pg. 21*

Genus species	var. or cv.	Year	Donor(s)
Polystichum aculeatum		04, '05	RSF, Gassner
Polystichum braunii		'07	Peachy
Polystichum x. bicknellii		'06	Gassner
Polystichum californicum		'05	RSF
Polystichum imbricans RAS07033		'07	Steffen
Polystichum imbricans RAS07004		'07	Steffen
Polystichum imbricans - forked form RAS07044		'07	Steffen
Polystichum lobatum		?	Gassner
Polystichum luctuosum		'03	RSF
Polystichum makinoi		'05	RSF
Polystichum mayebarae		'03, '05	Olsen
Polystichum munitum		'01	Taylor
Polystichum piceopaleaceum		'06	RSF
Polystichum retrosopaleaceum		'04, '06	Gassner, RSF
Polystichum tsus-simense		'03, '05	Duryee, Hill
Polystichum xiphophyllum		'04, '05	RSF, Duryee
Pteris vittata		'03	Briegel
Thelypteris palustris		'03	Briegel
Thelypteris patens		'03	Briegel
Woodsia intermedia		'05	RSF
Woodwardia areolata		'03	Briegel
Woodwardia fimbriata		'02	Mandeville
Woodwardia fimbriata RAS07056		'07	Steffen
Woodwardia virginica		'03, '05	Briegel

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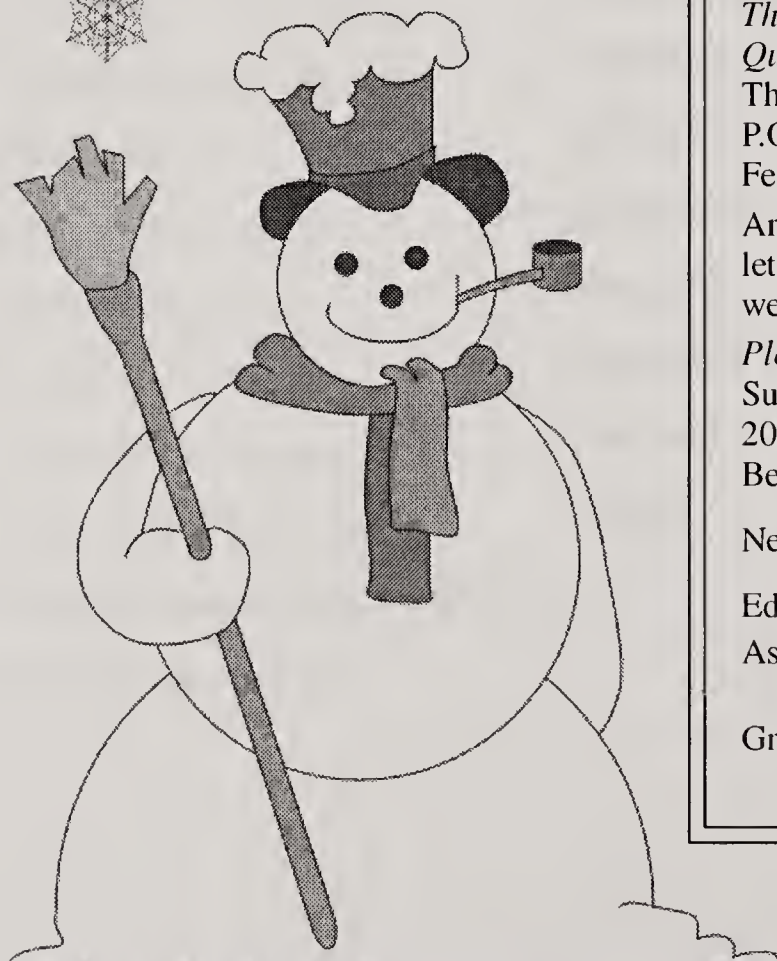
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THE HARDY FERN FOUNDATION QUARTERLY

*The Hardy Fern Foundation
Quarterly* is published quarterly by
The Hardy Fern Foundation,
P.O. Box 3797
Federal Way, WA 98036-3797

Articles, photos, fern and gardening questions,
letters to the editor, and other contributions are
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Please send your submissions to:

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